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EMPLOYED AND UNEMPLOYED SEARCH ACTIVITY: ESTIMATING INDIVIDUALS' MARGINAL WILLINGNESS TO PAY FOR ATTRIBUTES

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EMPLOYED AND UNEMPLOYED SEARCH ACTIVITY: ESTIMATING INDIVIDUALS' MARGINAL WILLINGNESS TO PAY FOR ATTRIBUTES

Abstract This paper introduces a method for estimating workers' marginal willingness to pay for job attributes employing data on job search activity. The empirical relevance of this method is shown by using studies that examine search behaviour in the U.S. and the Netherlands. We provide estimates of workers' willingness to pay for a wide range of job attributes including the risk of becoming unemployed and promotion prospects. Further, we discuss and apply a method for estimating unemployed individuals' willingness to pay for recall opportunities and the residual entitlement period. JEL: J3, J6.

1. INTRODUCTION

Since the eighteenth century, when Adam Smith wrote "The Wealth of Nations", economists have been interested in how the theory of compensating wage differentials might explain the existence of wage differences in the labour market. One of the attractions of this theory is that it allows for the estimation of workers' marginal willingness to pay (MWP) for job attributes such as collective bargaining and the risk of becoming unemployed. This may explain the impressive number of empirical hedonic wage studies that have focused on the workers' willingness to pay for attributes. Although many studies have shown that non-wage differences between jobs can be significant to workers, the genera1 conclusion is that non-wage differences between jobs are not very important to workers (see Brown, 1980).

The theory of compensating wage differentials assumes that workers have complete information in a static environment. This suggests that if job outcomes are a result of a dynamic process and workers having to search for jobs, estimates for the willingness to pay for job attributes may be biased. These considerations have therefore encouraged theoretical research that looks at the willingness to pay for attributes. In particular, it has been demonstrated that the estimates of the conventional marginal willingness to pay for a job attribute are likely to be biased downwards if it is not acknowledged that a job is a search good and a result of a match between an employer and a worker (Hwang et al., 1993).

These considerations have also generated a number of studies aimed at estimating the MWP for job attributes using data on *job moving* behaviour and comparing the MWP estimates with conventional estimates (Herzog and Schlottmann, '1990; Gronberg and Reed, 1994; Van Ommeren et al., 2000).[1] These studies point to considerably higher estimates than those based on conventional hedonic wage methods. Herzog and Schlottmann (1990) and Gronberg and Reed (1994) reported higher estimates for the willingness to pay to avoid job-induced risk. Van Ommeren et al. (2000) found higher estimates for the willingness to pay to avoid commuting. Similarly, Bartik et al. (1992) compared the MWP for residential characteristics based on *residential* moving behaviour and hedonic price methods and showed that the MWP estimates for crime reduction and school quality are higher than those based on conventional estimates. In addition, McCue and Reed (1996) examined self-reported data on the workers' willingness to pay for job attributes, and concluded that "workers' valuations of nonpecuniary dimensions of work

[1] In addition, these considerations have generated a number of studies to improve conventional estimates by correcting for mobility bias (see, for example, Kim (1992)).

are substantially larger than previous research has indicated".

Given the frequent use of hedonic-based models to assess the benefits of environmental, health and safety regulations in the labour and housing market, these results are relevant for theoretical and applied research and policy makers. "Hedonic-based benefit estimates should be used with caution, and other benefit estimation approaches should receive greater emphasis." (Bartik et al., 1992).

In this paper, we develop a method to estimate the MWP for job attributes that explicitly acknowledges that jobs are search goods. Assuming initially an elementary stationary environment in which workers search for jobs, we will demonstrate that the workers' MWP for job attributes can be derived from data on *job search activity*. This method is conceptually related to studies in which MWP estimates are derived from data on *job moving behaviour* by application of search theory (Gronberg and Reed, 1994; Van Ommeren et al., 2000). Later on, we will relax the assumptions regarding the search environment. For example, we allow workers to search in a nonstationary environment and to vary non-wage job attributes without changing job. As a result, the search method allows us to derive the MWP for goods like commuting time. Since commuting time varies with residential location, the MWP for commuting time will generally depend on workers' residential movement behaviour.

In the literature on the theory of compensating wage differentials there is a large interest in MWP estimates of the risk of becoming unemployed (Rosen, 1986). As is well known, search theory is particularly well suited to the analysis of the effect of risk on labour market behaviour (Mortensen, 1986). We will use data on search activity to provide plausible estimates of the willingness to pay for the risk of becoming unemployed.

The method developed here is used primarily to estimate the workers' willingness to pay for job attributes. However we will also discuss the possibilities of applying the same method to the estimation of the *unemployed* individuals' willingness to pay for unemployment attributes. In the current paper, we will provide estimates of (the upper bounds of) unemployed individuals' willingness to pay for the expectation of being recalled from layoff and for the residual entitlement period of receiving unemployment benefit.

The outline of the paper is as follows. In section two we introduce an elementary search model. We then derive the optimal search strategy in section three, and explain the method used to derive the workers' marginal willingness to pay for non-wage job attributes. In section four, we generalise the search model to increase the empirical relevance of the estimation method. Section five pays special attention to the unemployed individuals' MWP for unemployment attributes. In section six, the estimation method for the MWP is discussed. The empirical relevance of the method to estimate the individuals MWP for attributes is then demonstrated in section seven. Section eight concludes the paper.

2. THE ELEMENTARY SEARCH MODEL

The point of departure in this paper is an employed individual. This individual derives utility from job attributes X. v(X) is the quasi-concave instantaneous utility function associated with a job having attributes X. The once-only loss in utility due to moving job equals c. The person searches in the labour market with effort s at a cost of k(s). $s \geq 0$. Search costs k(s) are increasing and convex in search effort s, hence $k'(s) > 0$ and $k''(s) > 0$. Jobs arrive with arrival rate p(s). The job arrival rate p is increasing and concave in s, hence $p'(s) > 0$ and $p''(s) < 0$. We suppose that the effects of the search costs on the instantaneous utility function are additive, hence $v(X,s) = v(X) - k(s)$. Job attributes offers are drawn randomly from a given distribution. X_0 denotes the attributes of the job offered to the job searcher. Pooling of offers is not allowed: job offers are either refused or accepted before other offers arrive.

The expected lifetime utility received from the current job is denoted as V(X). V includes the possibility of offers in the future, which is discounted at rate ρ. The individual has to decide whether to accept a job offer, taking into account the expected offers in the future. The individual is assumed to maximise lifetime utility V. Discounted lifetime utility can then be written as the sum of the instantaneous utility and the expected benefit of accepting a job offer. So, V can be written as:

$$\rho V(X) = v(X) - k(s) + p(s) E \max[V(X_0) - c - V(X), 0] \qquad (1)$$

In this expression the expectation is taken with respect to the distribution of the job attributes X_0. The interpretation of the above formula is well known. Note that at rate p(s) a job offer will be received, and that offer will be accepted if the value of the new job exceeds that of the current position plus the moving costs. Hence, the optimal acceptance strategy is to accept a job offer if $V(X_0) - c - V(X) > 0$. The offer should otherwise be rejected. In the case that job moving costs c are zero, the optimal acceptance strategy can be simplified: accept a job offer if $v(X_0) - v(X) > 0$, otherwise reject the offer.

3. THE MARGINAL WILLINGNESS TO PAY FOR JOB ATTRIBUTES

In this section, the choice of search effort s is derived using the first-order condition for the worker's optimal search effort. The optimal choice of s is obtained by differentiating equation (1) with respect to s, and setting the resultant to zero:

$$-\frac{\partial k}{\partial s}+\frac{\partial p}{\partial s}E\max[V(X_0)-c-V(X),0]=0 \qquad if\ s>0 \tag{2}$$

The interpretation of equation (2) is well known (Mortensen, 1986). The marginal search costs equals the marginal benefit of an increase in the job arrival rate. The second-order condition is that the left-hand side of equation (2) is decreasing in s. The concavity of p and the convexity of k in their arguments ensure that this condition will be satisfied.

We will use equation (2) to express the marginal change of a change in a job attribute X_i on the workers' search effort. Dividing both sides by $\partial p/\partial s$, differentiating with respect to X_i and using the envelope theorem ($\partial V/\partial s=0$ if s > 0), gives:

$$\frac{\partial s}{\partial X_i}\frac{\partial}{\partial s}[-\frac{\partial k}{\partial s}/\frac{\partial p}{\partial s}]-\Pr[V(X_0)-c-V(X)>0]\frac{\partial V(X)}{\partial X_i}=0 \quad if\ s>0 \tag{3}$$

where $\Pr[V(X_0) - c - V(X) > 0]$ denotes the probability of accepting a job offer and where i = 1,..., n+l. Suppose that the n+1's job attribute is the wage. The workers' marginal willingness to pay for the ith nonwage job attribute (MWP_i) is then defined as the ratio of the marginal *lzjêtime* utility of the ith job attribute over the marginal *lifetime* utility of the wage. Hence, by using equation (3), we obtain:

$$MWP_i=\frac{\partial s}{\partial X_i}/\frac{\partial s}{\partial w} \quad if\ s>0 \tag{4}$$

where i= 1,...,n. Our first result is that the workers' marginal willingness to pay for the ith non-wage job attribute, MWP_i, equals the ratio of the marginal effects of the ith non-wage attribute and the wage on search effort, conditional on search. Clearly, if s = 0 then $\partial s/\partial w = 0$ and $\partial s/\partial X_i = 0$, and $\partial s/\partial X_i/\delta s/\delta w$ does not equal MPW_i , i= l,...,n.

Our second result is also straightforward to obtain. Since V= V(v(X),s(X)), and using the envelope theorem, one can readily see that:

$$\frac{\partial V}{\partial X_i} / \frac{\partial V}{\partial w} = \frac{\partial v}{\partial X_i} / \frac{\partial v}{\partial w} \quad if\, s > 0 \tag{5}$$

Thus, we have shown that the ratio of the marginal *lzjètime* utility of the job attributes equals the ratio of the marginal ***instantaneous*** utility of the job attributes. As a consequence, the MWP_i is equal to the ratio of the marginal *instantaneous* utility of the ith job attribute over the marginal *instantuneous* utility of the wage.[2] And, therefore:

$$\frac{\partial s}{\partial X_i} / \frac{\partial s}{\partial w} = \frac{\partial v}{\partial X_i} / \frac{\partial v}{\partial w} \quad if\, s > 0 \tag{6}$$

Consequently, the ratio of the marginal effects of the ith non-wage attributc on thc wage on the search effort equals the marginal instantaneous utility of the ith job attributc over the marginal instantaneous utility of the wage, conditional on search. In summary, givcn information on $\partial s/\partial X_i/\partial s/\partial w$, s > 0, one obtains (i) the MWP_i for job attribute X_i; (ii) the ratio of the marginal

[2] One may also assume that the MWP_i equals the ratio of the marginal instantaneous utility of the ith attribute over the marginal instantaneous utility of the wage (see Gronberg and Reed, 1994).

effects of job attribute X_i over the wage on the instantaneous utility function. Note that if the optimal search effort s = 0, then $\partial s/\partial w=\partial s/\partial X_i = 0$, i =1,..., n, and MWP_i does not equal $\partial s/\partial X_i/\partial s/\partial w$.

4. THE SEARCH ENVIRONMENT REVISITED

The on-the-job search model introduced in section 2 is the standard theoretical framework to understand on-the-job search. For empirical applications however, it may be too simplistic. It is therefore useful to investigate whether the results derived above stil1 hold under weaker, and therefore more realistic, conditions.

Nonstationarity. Empirical applications of on-the-job search and job moving behaviour indicate that workers are active in a nonstationary environment. In particular, on-the-job search activities decrease with the time being in the current job (Kalm and Low, 1984; Parsons, 1991; Van Ophem, 1991). We will therefore introduce time 't' into the model, which denotes the job duration. We suppose that the structural parameters of the search environment (v, p, c, k and 6) are nonstationary and depend on t, (see Van den Berg, 1990). This implies that lifetime utility is nonstationary, so V= V(t), and, therefore, search effort is nonstationary, so s = s(t).

Unemployment. It is natura1 to assume that the employed individuals take into account the fact that they may become unemployed in the future. We assume that unemployed individuals will receive a benefit b. Let δ denote the involuntary separation rate of workers from jobs. δ may depend on job nonwage attributes X, so δ = 6(X). For example, collective bargaining coverage generally decreases the risk of becoming unemployed.

The opportunity to vary non-wage job attributes without moving job. Job search models are based on the assumption that job attributes are fixed to the job and cannot be varied without moving job. More realistically, workers vary non-wage job attributes. For example, by moving residence, the commuting costs change (see Van Ommeren et al., 1997; 1998). We assume that workers may vary non-wage attributes X into X_1 at rate q without changing jobs. We assume that the costs of changing X into X_1 are equal to d. The worker will vary job attributes only if the expected benefits of changing non-wage attributes are larger than the costs.[3] In the remainder of this section, we will write V as V(X, w) to make clear that w cannot be varied, whereas non-wage attributes X may be varied.

Given the assumptions stated above, lifetime utility V(X,w) can be written as:

$$\rho V(X,w) = \partial V(X, w)/ \partial t + v(X ,w) -k(s) + p(s)E\max[V(X_0,w) -c -V(X,w),0] \qquad (7)$$
$$+ \delta(X)[V(b) -V(X,w)] + qE\max[V(X_1 ,w) -d -V(X,w),0]$$

Equation (7) can be interpreted as follows (see, similarly, Van den Berg, 1990). The discounted lifetime utility is equal to the sum of the appreciation of lifetime utility V at t, the instantaneous utility, the expected benefit of accepting a job offer, the expected loss of becoming unemployed - which cannot be avoided - and the expected benefit of changing job attributes.

The optimal choice of s can be obtained by differcntiating equation (7) with respect to s, and setting the resultant equal to zero. Going through thc same mathematica1 steps as in the previous sections - and making use of the optimality condition that $\partial(\partial V/\partial t)\partial s = \partial(\partial V/\partial s)/\partial t = 0$ - we find again that $MWP_i = \partial s/\partial X_i/\partial s/\partial w$, if s > 0.

[3] This extension of the elementary model is interesting when changing nonwage attributes is costly and subject to change. Otherwise, these attributes would be instantly optimally chosen and become permanent.

We see now that lifetime utility cannot be written as $V(v(X,w),s(X,w))$, but as $V(v(X,w),s(X,w),X,w)$, since lifetime utility depends directly on X and on w via 6(X) and $V(X_1,w)$. As a consequence, $\partial V/\partial X_i/\partial V/\partial w$ cannot be written as $\partial v/\partial X_i/\partial v/\partial w$. This implies that the ratio of the marginal effects of the ith nonwage attibute and the wage on the search effort does not equal the marginal instantaneous utility of the ith job attribute over the marginal instantaneous utility of the wage. In summary, under the weaker conditions stated above, one may interpret $\partial s/\partial X_i/\partial s/\partial w$ as $MWP_{i,}$ however identification of the ratio of the marginal effects on the instantaneous utility function is not possible.

5. UNEMPLOYMENT

In previous sections, we have discussed the relationship between on-the-job search effort and *workers*' marginal willingness to pay for job attributes. Similarly, the *unemployed* individuals' marginal willingness to pay for non-pecuniary attributes that explicitly depend on the current state of unemployment can be derived by supposing that the n+l 's attribute is the unemployment benefit b. An example of such an unemployment non- pecuniary attribute is the expectation of being recalled to the previous job from layoff. Another example is the residual entitlement period.

6. ESTIMATION METHOD

We will discuss here a method for estimating workers' MWP for job attributes given information on search behaviour. Suppose that exact information on search effort is not available and it is only known whether workers search (s = 1) or do not search (s =0).[4] One may then specify search activity s by means of a latent-variable framework by introducing the latent variable s^* (desired search effort): $s^* = \beta'Y + u$, $E(u) = 0$; β is a vector of unknown coefficients. Y represents a vector of explanatory variables and Y includes job attributes X; u is a random variable with expectation 0.[5] s and s^* are related as follows: $s = 1$, if $s^* > 0$; $s = 0$ otherwise.

Let β_i the parameter associated with job attribute X_i, i= 1,..., n+l. It is then obvious that $\delta E(s^*)/\delta X_i = \beta_i$, i= l,...n+l. In addition, $\delta E(s^*|s^* > 0)/\delta X_i$, can then be written as $\alpha.\beta_I$ where $\alpha > 0$, i= l,...n+l (Maddala, 1985). Suppose that the n+1's job attribute is the wage and let β_w be the parameter associated with the wage. Hence, β_i/β_w equals the ratio of the marginal effects of the ith nonwage attribute and the wage on search effort, *conditional that the worker is engaged in search,* and thus:

$$MWP_i = \beta_i/\beta_w, \quad 1, \ldots, h. \tag{8}$$

In consequence, estimates of β_i/β_w can be interpreted as the workers' marginal willingness to pay for the ith non-wage job attribute (MWP_i).

The assumption that search effort depends linearly on the job attributes implies that the workers' MWP does not depend on any current wage or nonwage job attribute (see equation (8)). In most empirical applications of on-the-job search behaviour however, it is assumed that the wage determines search effort non-linearly. The most common specification is that the logarithm

[4] The same result can be obtained if one observes search effort in a different way. For example, one may observe the number of search hours per week (leading to a tnmcated variable model) or the number of search contacts per week (leading to a Poisson model).
[5] Strictly speaking, unobserved heterogeneity is not explicitly introduced in the search model. However, this weakness can be easily removed by making the assumption that search costs are drawn from a population distribution.

of the wage determines search effort. Such a specification implies that the MWP_i equals $w.\beta_i/\beta_w$. Hence, the MWP_i is proportional to the current wage. The unemployed individuals' MWP for unemployment attributes can be estimated in a similar way.

7. EMPIRICAL APPLICATIONS

In this study, we make use of one study that has examined workers' job search behaviour in the U.S.: Parsons (1991) and one in the Netherlands: Van Ophem (1991).[6] Given the estimates of the determinants of job search activity as reported in these studies, we derive workers' MWP for job attributes (section 7.1). Results published by Barron and Mellow (1979) for the U.S. and Lindeboom and Theeuwes (1993) for the Netherlands on the unemployed individuals' search behaviour are used to derive the unemployed individuals' MWP for unemployment attributes (section 7.2).

7.1. On-the-job search

We provide the estimates of the MWP for job attributes using the estimation method discussed in section 6.[7] To facilitate comparison of the results, we provide estimates of the MWP for a job attribute divided by the wage (multiplied by 100) denoted as %MWP. One advantage of this

[6] Other on-the-job search studies include Rosenfeld (1977), Black (1981), Hartog et al. (1988), Blau and Robins (1990), Burgess and Low (1992), Banerjee and Bucci (1994), Pissarides and Wadsworth (1994) and Hartog and Van Ophem (1994). These studies do not allow us to identify the effects of wage and nonwage attributes on workers' search activity.

[7] The variance of the estimated MWP_i is derived using the delta method, so $Var(\beta_i/\beta_w)$ is calculated as $[Var(\beta_i)+(\beta_i/\beta_w)^2.Var(\beta_w)-2.(\beta_i/\beta_w)Cov(\beta_i/\beta_w)]/\beta_w^2$. As it is common practice not to report the covariance matrix of the coefficients, we suppose that $Cov(\beta_i,\beta_w)$ is zero. Hence, the reported precision of the MWP estimates is somewhat inaccurate. For the current application, this is not problematic. In the case that MWP_i equals zero, variances of the MWP_i estimates are exact so one may test the hypothesis that MWP_i equals zero using a standard t-test. In addition, when MWP_i is positive, the bias in the variance is small, even for a relatively high correlation between β_i and β_w. For example, if the correlation between β_i and β_w is 0.2, which is high in this type of application, then the relative bias in the standard error is less than 10% (for a full proof, see van Ommeren, 2002).

measure is that it is the closest to the empirical specifications employed by the studies discussed here.

Parsons (1991). Parsons (1991) used the 1980-1981 National Longitudinal Survey of Youth to study the employed workers' choice among employed search, unemployed search, and not searching for a new job. Ordered probit models are employed for men and women. The wage rates are specified in logarithms. The results show that current wages, promotion prospects, job tenure (for men, not for women) and full-time work are each negatively associated with search intensity (see Table 1).

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Insert Table 1

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Parsons (1991) found that workers searched more if they worked part-time. Thus the average part-time worker prefers to work more hours than available on their current job. Hence, the marginal rate of substitution of wage for leisure is less than the current wage rate.[8] The results also indicate that the MWP for a full-time position is higher for men (65% of the current wage) than for women (35% of the current wage). Such a finding is consistent with the notion that men generally prefer to work more hours than women. The results clearly show that workers search significantly less if they expect to be promoted. Promotion opportunities are highly valued by workers. 'Very good promotion prospects' are valued at 176% for men and 225% for women. 'Good promotion prospects' are valued at 112% for men and 144% for women. 'Not so good promotion prospects' are valued at 84% for men and at 42% for women (the latter is not significant at conventional levels of significance). We find that the MWP for promotion prospects is not strongly gender dependent.

We will explain by application of search theory that these estimates of the MWP for promotion prospects are plausible. To simplify matters, we suppose a simplified search model that allows us to obtain an explicit solution for the MWP for promotion prospects. Suppose a worker eams wage w and expects to be promoted at rate λ. Promoted workers receive a wage w^p forever ($w^p > w$). The worker discounts the future at rate ρ. Job-to-job mobility is ignored. Lifetime utility V can then be written as $(\rho w+\lambda w^p)/\rho(\rho+\lambda)$ and the MWP for λ equals $(w^p-w)/(\rho+\lambda)$ (since $\partial V/\partial w = 1/(\rho+\lambda)$ and $\partial V/\partial\lambda = (w^p-w)/(\rho+\lambda)^2$). So, the MWP for λ is positive, and decreasing and concave in λ.

In Parson's (1991) empirical specification of job search behaviour, dummies for various levels of promotion prospects are included. Each dummy indicates a different leve1 of λ. So, the MWP for a dummy can be interpreted as the willingness to pay (WP) for a certain level of λ. The willingness to pay for λ is defined as $[V(\lambda)-V(0)]/\partial V/\partial w$ and can be written as $\lambda.(w^p-w)/\rho$. Now suppose that the determinant 'very good promotion prospects' implies that λ/ρ is 5. This seems quite reasonable, for example, the yearly promotion rate λ might be 0.50 and the yearly discount rate ρ is 0.10. Since Parsons' (1991) empirical results indicate that the percent MWP for 'very good promotion prospects' is about 200%, promoted workers receive a wage increase of 40%. Such an estimate seems plausible (see Murphy, 1985; van Garneren, 1999).

Van Ophem (1991). Van Ophem (1991) used the 1985 OSA Labour Market Survey to study the importance of nonwage attributes on the search decision of Dutch employees. A

[8] The marginal rate of substitution of wage for leisure is equal to the wage rate provided that search activity is (i)

measure for the monetary incentive to search is the determinant log(predicted wage rate) - log(wage rate). The results show that on-the-job search activity increases with monetary incentives, unemployment expectations, unpaid overtime and commuting time, but decreases with job tenure and good promotion prospects. Different measures for the predicted wage are used using a 'structural form' and 'reduced form' model. In the current paper, we report the MWP for job attributes based on the 'reduced form' model (see Table 2).[9] Van Ophem (1991) reports that workers search more if they commute more, work unpaid overtime and expect to become unemployed within a year. Workers search less if they have good promotion prospects or have longer job tenure. The MWP for commuting time (minutes per day, one way) is -1.40% of the hourly wage rate. Interpretation of the MWP for commuting time is facilitated by focusing on the MWP for one hour commuting (30 minutes of commuting, one way). The results imply that the average Dutch worker who works seven hours a day is willing to pay 294% of the hourly wage to avoid a one hour loss of leisure time due to commuting (standard error of 147). This nurnber is somewhat higher than those reported by the majority of studies, which generally find estimates of less than 100 (see Small, 1992), but in line with studies such as Zax (1991). The workers' MWP for the absence of unpaid overtime (measured in hours per week) is 4.75% of the weekly wage. In the Netherlands, the average employed individual works about 35 hours per week. Workers' MWP for the absence of unpaid overtime is therefore, on average, 166% of the wage rate (standard error is 60). Thus, the percent MWP for the absence of one hour unpaid overtime is not significantly different from 100 (even at the 10% level) and we cannot refute the hypothesis that the marginal rate of substitution of wage for leisure equals the wage rate.

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affected by the *hourly* wage rate and (ii) not affected by the number of work hours.

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Insert Table 2

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Van Ophem (1991) includes a determinant of search activity defined as 'the expectation of becoming unemployed within 12 months'. The MWP for the absence of this expectation is about 147% of the wage rate. Consequently, Dutch workers who expect to become unemployed within 12 months anticipate a substantial loss. This is likely to be due to low re-employment probabilities in the Dutch labour market, since the direct loss in income is relatively smal1 in the Netherlands. Using a simple search model, we will show that the estimates are plausible. Suppose an individual is employed, earns wage w and anticipates becoming unemployed at rate 6. When unemployed, this individual will receive a benefit b and will find again a job at rate λ (w > b). In the new job, the individual will earn wage w and anticipates becoming unemployed at rate 6. The individual discounts the future at rate p. Lifetime utility V can then be written as $((\rho+\lambda)w+\delta b)/(\rho(\rho+\delta+\lambda)$. This implies a willingness to pay (WP) for δ which equals $\delta(b-w)/(\rho+\lambda)$ and a *marginal* willingness to pay (MWP) for δ which equals $(b-w)/(\rho+\lambda+\delta)$. We assume now that λ is 0.66 and ρ is 0.10. The expected duration of being unemployed after losing the job is then 1.5 years, which corresponds to the average Dutch unemployment duration during the period 1983-1987 (Gorter et al., 1990). The determinant 'the expectation of becoming unemployed within a year' seems to indicate a large yearly separation rate. We assume that δ is three (the probability of becoming unemployed within a year is then 0.90). In 1985, the Dutch unemployment insurance payment initially amounted to 80% of the most recently eamed wage,

[9] The estimates of the MWP for job attributes based on the 'structural form' model are larger in absolute value, but less statistically significantly different from zero.

however, this was reduced after a maximum of six months. Thus, the loss in eamings is more than 20%. For simplicity, we assume that (b-w)/w is -30%. Given these assumptions, the WP for the absence of δ is 118%. Such a number is quite close to the 147% implied by the results reported by Van Ophem (1991). Clearly, higher re-employment rates λ imply a lower WP for the absence of 6, since the expected duration of being unemployed is shorter. In the case that λ is one, the WP for the absence of δ is 59%. Furthermore, the *marginal* willingness to pay for the absence of δ is decreasing in λ and in 6. In the case that λ is 0.66 and ρ is 0.10, the percent MWP for the absence of the yearly separation rate δ decreases from 39% (6 = 0) to 2.5% (6 = 10). Finally, and in line with the estimates implied by the results of Parsons (1991), Van Ophem reports that 'good promotion prospects' are valued at about the current wage rate (MWP is 97% of the wage). As argued before, this result is plausible. The two studies discussed above employ different data sets, estimation methods and empirical specifications. However, they both include job tenure as a determinant of job search. Hence, this gives US the opportunity to compare estimates. Job tenure may be regarded as a beneficial job 'attribute', since tenure generally is associated with more job security, higher levels of pension, so it has a negative effect on job search.

For example, Kahn and Low (1984) used the 1969-1971 National Longitudinal Surveys data on young men to study the employed workers' choice among employed search, unemployed search, and not searching for a new job. A trichotomous logit model is employed. The wage rates are specified in logarithms. The results show that current wages and job tenure are each negatively associated with search intensity (see Table 3).

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Insert Table 3

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We found that the study by Parsons (1991) implies a percent MWP for job tenure of 25% (young men), and 1 1% (young women); the study by Kahn and Low (1984) implies 29% (young men), and the study by Van Ophem (1991) implies 14%. It is worth noting that Parsons' (1991) and Kahn and Low's (1984) estimates of the young men's MWP for job tenure by are ahnost identical, whereas the young women's MWP for job tenure is lower. The study by Van Ophem (1991), which does not distinguish between men and women, indicates a somewhat lower MWP. Given the noted differences between the studies, the results seem to cover a relatively smal1 range. We conclude therefore that the estimation method used here generally robust results among different studies.

7.2. Unemployed job search

Barron and Mellow (1979). Barron and Mellow (1979) used a special survey among a sample of the unemployed respondents in the May 1976 U.S. Current Population Survey, to study the unemployed individual's choice of how much time to devote to searching for a job. Particular attention was paid to the role of unemployment insurance benefits and to individuals who have recently been (temporarily) laid off. Regression models are employed for the full sample and for a sample restricted to individuals entering unemployment from prior jobs. The weekly insurance benefits are assumed to affect search time linearly. Dummies are used for 'expected recall. within 30 days' and 'expected recall, no period specified'. The results show that the unemployment insurance benefits and recall expectations reduce unemployment search time. In Table 3, the results are given for the sample restricted to individuals entering unemployment from prior jobs.[10]

The MWP for expected recall within 30 days is 3 13 dollars, which is about four times the average weekly benefít (for the 31% receiving benefits, the mean is 77 dollars). Therefore unemployed individuals are willing to forgo benefit for a month to receive a recall within a month. The MWP for expected recall when the period is not known is 144 dollars, almost twice the average weekly benefit.

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Insert Table 4

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Lindeboom and Theeuwes (1993). Lindeboom and Theeuwes (1993) used a random sample drawn from the 1982-1984 administrative records of the Dutch unemployment benefit administration for the Leiden district to study the determinants of search effort. One of the determinants is the residual entitlement period of receiving unemployment benefit. Under the Dutch Unemployment Act, the benefít leve1 considered is approximately 80% of gross eamings before unemployment. The length in days of unemployment benefit entitlement depends on the number of days worked. The maximum benefit duration is 26 weeks. At the end of the unemployment entitlement period, the benefit drops to 94% of the benefit leve1 (75% of previous eamings). Depending on the length of the prior job, the uncmployed will receive this benefit for a certain period. Ultimately, the unemployed receive welfarc, which is generally substantially less than the benefit and which does not depend on previous income. Search effort is measured by the number of search contacts. The analysis is based on a Poisson model. The results show that

[10] The results for the full sample imply somewhat higher – but less significant – MWP estimates.

search effort declines significantly with increasing benefit levels, and rises over the residual entitlement period (see Table 5)

* * * * * * * * * * * * * * * *

Insert Table 5

* * * * * * * * * * * * * * * *

These results imply that the MWP as a percentage of the benefit for residual entitlement (in weeks) is equal to 13.33% -0.26% times the residual entitlement period. Hence, the MWP for residual entitlement is positive over the entitlement period (maximally 26 weeks) and increases at a weekly rate of 0.26% of the benefit as the end of the entitlement period comes near. The willingness to pay for one week extra residual entitlement, at the beginning of entitlement, is 6% of the benefit level. The willingness to pay for one week extra residual entitlement, at the end of the entitlement period, is 13% of the benefit level. The empirical outcomes seem quite plausible, since, as explained above, at the end of the entitlement period considered, unemployed individuals lose at least six percent of the benefit for a certain period and, after this period the benefit will be reduced to welfare level.

8. CONCLUSION

In this paper, we have demonstrated that the marginal willingness to pay for job attributes can be derived from data on on-the-job search activity. The empirical relevance of the search approach to estimate the workers' marginal willingness to pay is demonstrated based on a number of studies in the U.S. and the Netherlands. We have provided evidence, that workers attach substantial value to non-wage differences between jobs like commuting time, unpaid overtime, risk of becoming unemployed and promotion prospects. Furthermore, we demonstrate that data on unemployed individuals' search behaviour may be useful in obtaining information on the value of unemployment attributes such as recall opportunities and the residual entitlement period of receiving unemployment benefit.

LITERATURE

Altonji, J.G. and C.H. Paxson (1988), Labor supply preferences, hours constraints, and hours wage trade-offs, *Journal of Labor Economics,* 2, 254-276

Banerjee, B. and G.A. Bucci (1994), On-the-job search after entering urban employment: an analysis based on Indian migrants, *Oxford Bulletin of Economics and Statistics, 56, 33-47*

Barron, J.M. and W. Mellow (1979), Search effort in the labor market, *Journal of Human Resources,* 14, 389-404

Bartik, T.J., J.S. Butler and J.T. Liu (1992), Maximum score estimates of the determinants of residential mobility: Implications for the value of residential attachment and neighborhood amenities, *Journal of Urban Economics,* 32, 233-256

Black, M. (1981), An empirical test of the theory of on-the-job search, *Journal of Human Resources,* 16, 129-140

Blau, D.M. and P.K. Robins (1990), Job search outcomes for the employed and unemployed, *Journal of Politica1 Economy*, 98, 637-655

Brown, C. (1980), Equalizing differences in the labor market, *Quarterly Journal of Economics,* 113-134

Burgess, P.L. and Low, S.A. (1992), Preunemployment job search and advanced job loss notice, *Journal of Labor economics,* 10, 258-287

Gorter, C., P. Nijkamp, and P. Rietveld (1990), The duration of unemployment, stocks and flows on flows on regional labour markets in the Netherlands, *Applied Economics, 22,* 155-177

Gronberg, T.J. and W.R. Reed (1994), Estimating workers' marginal willingness to pay for job attributes using duration data, *Journal of Human Resources, 24, 9* 11-93 1

Hartog, J. and H. van Ophem (1994), On-the-job search and the cyclical sensitivity of job mobility, *European Economic Review, 38, 802-808*

Hartog, J., E. Mekkelholt and H. van Ophem (1988), Testing the relevance of job search for job mobility, *Economics Letters,* 27, 299-303

Herzog, H. W. Jr. and A.M. Schlottmann (1990), Valuing risk in the workplace: market price, willingness to pay, and the optimal provision of safety, *Review of Economics and Statistics, 72, 463-470*

Hwang, .H. D., W.R Reed and C. Hubbard (1993), Compensating wage differentials and unobserved productivity, *Journal of Politica1 Economy*, 100, 4, 835-858

Kahn, L. and S. Low (1984), An empirical model of employed search, unemployment search and nonsearch, *Journal of Human Resources,* 19, 104- 117

Kim, S. (1992), Search, hedonic prices and housing demand, *Review of Economics and Statistics,* 74, 503-508

Lindeboom, M. and J. Theeuwes (1993), Search, benefíts and entitlement, *Economica, 60, 327-347*

Maddala, G.S. (1985), Limited-dependent variable models using panel data, *Journal of Human Resources,* 22, 3, 307-338

McCue, K. and W.R. Reed (1996), New evidence of workers' willingness to pay for job attributes, *Southern Economic Journal,* 62, 3, 627-652

Mortensen, D.T. (1986), Job search and labor market analysis, in O.C. Ashenfelter and R. Layard (eds.), *Handbook of Labor Economics,* Amsterdam, North-Holland

Murphy, K.J. (1985), Corporate performance and managerial remuneration: an empirical analysis, *Journal of Accounting and Economics, 7,* 11-42

Parsons, D.O. (1991), The job search behavior of employed youth, *Review of Economics and Statistics, 37, 597-604*

Pissarides, C.A. and J. Wadsworth (1994), On-the-job search: some empirical evidence from Britain, *European Economic Review, 38,385401*

Rosen, S. (1986), The theory of equalizing differences, in O.C. Ashenfelter and R. Layard (eds.), *Handbook of Labor Economics,* Amsterdam, North-Holland

Rosenfeld, C. (1977), The extent of job search by employed workers, *Monthly Labor Review,* (March), 58-62

Small, K.A. (1992), *Urban transport economics,* Fundamentals of Pure and Applied Economics, Harwood, Chur

Van Garneren, E. (1999), The intemal economics of firms: an investigation into the labor mobility within firms, Tinbergen Institute Research Series, Amsterdam, The Netherlands

Van den Berg, G.J. (1990), Nonstationarity in job search theory, *Review of Economic Studies, 5,* 255-277

Van Ophem, H. (1991), Wages, nonwage job characteristics and the search behavior of employees, *Review of Economics and Statistics*, 145- 15 1

Van Ommeren, J.N. (2002), A note on workers' willingness to pay for non-wage job attributes and labor mobility, Free University, Research Memorandum, 2002

Van Ommeren, J.N., G.J. Van den Berg and C. Gorter (2000), Estimating the marginal willingness to pay for commuting, *Journal of Regional Science,* 40, 3, 541-563

Van Ommeren, J.N, P. Rietveld and P. Nijkamp (1997), Commuting: in search of jobs and residences, *Journal of Urban Economics,* 42, 402-411

Van Ommeren, J.N, P. Rietveld and P. Nijkamp (1998), Spatial moving behaviour of two-eamer households, *Journal of Regional Science, 38,* 1, 23-41

Zax, J.S. (1991), Compensation for commuter in labor and housing markets, *Journal of Urban Economics, 30,* 192-207

Table 1. Coefficients of search activity (encompasses search plans) with respect to attributes, out-of-school, aged between 17 and 23, U.S., 1980-1981 (based on Parsons, 1991) and the marginal willingness to pay for job attributes.

	men		women	
variables	coefficient	% MWP	coefficient	% MWP
log wage rate	-0.573		-0.484	
	(0.129)[a]		(0.165)[a]	
job tenure (years)	-0.140	24.5	-0.062	10.9
	(0.050)”	(10.4)[b]	(0.106)	(10.6)
part-time	0.373	-65.2	0.202	-35.3
	(0.173)[b]	(33.6)’	(0.108)’	(20.5)’
promotion prospects:				
very good	-1.008	175.9	-1.289	225.0
	(0.174)[a]	(49.9)[a]	(0.163)[a]	(58.1)[a]
good	-0.640	111.6	-0.827	144.3
	(0.180)’	(40.2)”	(0.141)’	(40.8)[a]
not good	-0.479	83.6	-0.240	41.9
	(0.183)’	(37.1)[b]	(0.149)	(27.7)
absent				

Notes: standard errors in parentheses. a: significantly different from zero at the 0.01 level, b significantly different from zero at the 0.05 level; c: significantly different from zero at the 0.10 level.

Table 2. Coeffcients of search with respect to job attributes, The Netherlands, 1985 (based on Van Ophem, 1991) and the present marginal willingness to pay for job attributes.

variables	coefficient	%MWP
log wage rate	-0.442	
	(0.165)	
commuting time (minutes, one way)	0.006	-1.40
	(0.002)	(0.72)[b]
job tenure (years)	-0.060	13.6
	(0.068)	(15.4)
unpaid overtime (hours per week)	0.021	-4.75
	(0.013)	(2.83)’
unemployment expectation	0.650	-147.06
	(0.106)	(46.24)[a]
good promotion prospects	-0.428	96.83
	(0.087)	(16.93)[a]

Notes: standard errors in parentheses. a: significantly different from zero at the 0.01 level; b: significantly different from zero at the 0.05 level; c: significantly different from zero at the 0.10 level.

Table 3. Coeffcients of search with respect to job attributes, men, aged between 17 and 23, U.S., 1969-1971 (based on Kahn and Low, 1984) and the present marginal willingness to pay for job attributes.

variables	coefficient	%MWP
log wage rate	-0.706	
	(0.180)	
job tenure (years)	-0.204	28.95
	(0.037)	(9.06)[a]

Notes: standard errors in parentheses. a: significantly different from zero at the 0.01 level.

Table 4. Coeffcients of search time (search hours per week) with respect to attributes of unemployed individuals entering unemployment from prior jobs in 1976, U.S. (based on Barron and Mellow, 1979) and the marginal willingness to pay for unemployment attributes.

variables	coefficient	MWP/AWB	MWP
weekly insurance benefit	-0.019		
	(0.006)[a]		
expected recall,	-5.950	4.065	313.15:
within 30 days	(1.390)[a]	(1 .674)[b]	(129.11'
expected recall,	-2.740	1.873	144.21
no period specified	(0.739)[a]	(0.81 1)[b]	(62.44:

Notes: Standard errors in parentheses. a: significantly different from zero at the 0.01 level; b: significantly different from zero at the 0.05 level. AWB: average weekly benefit.

Table 5. Coefficients of search contacts of unemployed individuals receiving unemployment benefit in 1982-1984, Leiden, The Netherlands (based on Lindeboom and Theeuwes, 1993) and the marginal willingness to pay for unemployment attributes as a percentage of the benefit.

variables	coefficient	%MWP
log benefit	-0.27	
	(0.031)'	
residual entitlement period	-0.036	13.33
	(0.005)"	(2.40)[a]
(residual entitlement period)^2	0.0007	-0.26*residual entitlement period
	(0.0002)'	(0.08)"

Notes: Standard errors in parentheses. a: insignificantly different from zero at the 0.01 level. Residual entitlement period measured in weeks.